

PATENT SPECIFICATION

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(54) A THRUST BEARING STRUCTURE

(71) We, YOSHIDA KOGYO K.K., a corporation duly organized under the laws of Japan and existing at No. 1, Kanda Izumicho, Chiyoda-ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a thrust bearing, and more particularly to a thrust bearing structure suitable for runners for horizontally sliding doors or for furniture castors, which is characterized by a minimum of operating noise and a high resistance to mechanical wear.

Conventional thrust bearings for runners for horizontally sliding doors and furniture castors are made of metallic material, so that such conventional bearings have the drawback that they tend to produce a relatively loud noise during operation and they are prone to wear out due to the metal-to-metal friction therein.

According to the invention there is provided a thrust bearing assembly comprising a pair of synthetic resin blocks, between which metallic rolling elements located by a synthetic resin retainer are rotatably disposed, the metallic rolling elements being balls or rollers, surfaces of the blocks which come in contact with the rolling elements having circular bearing grooves, so as to guide the rolling of the elements by receiving respective portions thereof, a shaft being rotatably disposed in and extending through centrally extending bores of the synthetic resin blocks and of the synthetic resin retainer, said bores being concentric with the circular bearing grooves of the blocks.

In one embodiment of the invention said shaft has a top end thereof secured to a mounting plate, a relatively large diameter portion formed at a lower part thereof, and a disk-shaped portion formed at the lower end thereof so as to extend radially further than the outer periphery of said relatively large diameter portion of the shaft; a cylindrical roller being rotatably fitted on the relatively

large diameter portion of the shaft, the shaft extending through a central bore of said cylindrical roller, which is supported by said disk-shaped portion of the shaft; a lower one of said synthetic resin blocks being rotatably held above said relatively large diameter portion of the shaft on a relatively small diameter portion of the shaft; said retainer having uniformly spaced radial openings adapted to retain said rolling elements at uniform intervals in said bearing grooves.

In another embodiment of the invention a furniture castor includes a thrust bearing according to the invention, an upper one of said blocks having a threaded projection, the top end of the shaft having a disk-shaped expanded portion which rests on the top surface of the upper block, the threaded projection being threadably engageable with a piece of furniture, the metallic rolling elements being located by radial openings of the retainer, a bracket having a top surface which engages a bottom surface of the lower block, the lower end of the shaft being secured in position in a central bore of the bracket, a wheel shaft extending across opposite side walls of the bracket, and rotatably carrying a wheel.

The invention will be described by way of examples with reference to the accompanying drawings, wherein:—

Figure 1 is an elevation of a runner for a horizontally sliding door, into which a preferred thrust bearing according to the present invention is incorporated;

Figure 2 is a sectional view taken along the line II—II of Figure 1;

Figure 3 is an exploded view of the runner of Figure 1 for the horizontally sliding door;

Figure 4 is a partially cutaway elevation of a furniture castor including a thrust bearing according to the present invention; and

Figure 5 is an exploded view of the furniture castor.

Like parts are designated by like numerals throughout the different views of the drawings.

Referring now to Figures 1 to 3, a runner 10 for a horizontally sliding door (not shown)

is secured to the door by a mounting plate 21, for instance, to the bottom side of the door. A thrust bearing incorporated in the runner 10 comprises a lower block 11 made of synthetic resin, metallic rolling elements 15, e.g., metallic balls or rollers, a synthetic resin retainer 16 having radial openings 17 for rotatably carrying the rolling elements 15, one at each opening, so as to rotatably position the rolling elements 15 in a circular bearing groove 13 formed in the top surface of the lower block 11 at uniform intervals, an upper block 20 made of synthetic resin and having a circular bearing groove 22 receiving the top portions of the metallic rolling elements 15, and a shaft 18 extending through the central shaft holes 11a, 16a, 20a and 21a of the lower block 11, the retainer 16, the upper block 20, and the mounting plate 21, respectively. The top end of the shaft 18 is secured to the mounting plate 21 by any suitable conventional means, e.g., by caulking or bolting.

In the embodiment shown in Figures 1 to 3, the shaft 18 has a large diameter lower portion 18a rotatably carrying a hollow cylindrical roller 19 and a disk-shaped lower end 18b rotatably supporting the cylindrical roller 19. The bottom surface 14 of the lower block 11 is finished in the form of a truncated cone, for the purpose to be described hereinafter. To enclose the space between the upper block 20 and the lower block 11, the lower block 11 has a cylindrical edge wall 12 extending upwardly from the top end thereof into the space and the upper block 20 has an annular fringe wall 23 depending from the bottom thereof so as to surround the outside of the cylindrical edge wall 12 opposite to the shaft 18, as shown in Figure 2. Thus, any foreign matter, such as dust particles, is prevented from entering into the space between the upper block 20 and the lower block 11.

Radially inward and outward movement of the rolling elements 15, relative to the shaft 18, is restricted by the combination of the bearing grooves 13, 22 and the radial openings 17 of the synthetic resin retainer 16. Arms 16b formed of a synthetic resin alternate with adjacent openings 17 of the retainer 16, such that each metallic rolling element 15 comes in contact with the synthetic resin alone and not in metal-to-metal contact with the adjacent metallic rolling elements. In Figures 1 to 3, the metallic rolling elements 15 are illustrated in the form of balls, so that the bearing grooves 13 and 22 of the blocks 11 and 20 are preferably arcuate in cross section.

The runner 10 for a horizontally sliding door (not shown) engages the top of a tall vertical wall 25a of a channel-shaped guide rail 25 at the bottom surface 14 of the lower block 11, and the hollow cylindrical roller

rotatably engages the inner surface of a short vertical wall 25b of the channel-shaped guide rail 25. A thrust load applied to the thrust bearing of the runner 10 is resolved at the surface 14 of the block 11 into two components; namely, one component perpendicular to the surface 14 tending to urge the lower block 11 against the tall vertical wall 25a of the guide rail 25, and another component tending to urge the roller 19 against the short vertical wall 25b of the guide rail 25. Thus, the runner 10 is stabilized, bearing the thrust load by the tall vertical wall 25a of the guide rail 25. Furthermore, the truncated cone shape of the bottom wall 14 of the lower block 11 results in a kind of wedge action, which further stabilizes the engagement between the runner 10 and the guide rail 25, so that backlash of the runner 10 and the risk of slipping off of the runner 10 from the guide rail 25 can be eliminated.

The metallic rolling elements 15 ensure smooth and substantially noiseless rotation of the synthetic resin lower block 11 relative to the shaft 18, and the hollow cylindrical synthetic resin roller 19 also smoothly rotates about the shaft 18 in a substantially noiseless manner, so that the runner 10 slides smoothly along the guide rail 25. The cylindrical edge wall 12 and the cylindrical fringe wall 23 prevent rain water and dust particles from entering into the proximity of the metallic rolling elements 15. If, however, rain water should come in contact with the metallic rolling elements 15, the synthetic resin material of the blocks 11, 20 and the retainer 16 serves to polish the surfaces of the metallic rolling elements 15 so as to prevent the possible corrosion of the elements 15.

Figures 4 and 5 illustrate a furniture castor 40, according to the present invention, which includes the aforesaid construction of the thrust bearing. An upper block 20 made of synthetic resin has a central bore 20a and a threaded projection 20b. A shaft 18 extends through the central bore 20a, and the top end of the shaft 18 has a disk-shaped expanded portion which rests on the top surface of the upper block 20. The projection 20b is threadably engageable with the lower end of a piece of furniture (not shown). The shaft 18 also extends through the central bore 16a of a retainer 16 and the central bore 11a of a lower block 11, both of which retainer 16 and block 11 are made of synthetic resin. There is formed a space defined between the upper block 20 and the lower block 11, where metallic rolling elements 15 located by the radial openings 17 of the retainer 16 are disposed in a rotatable manner. The metallic rolling elements 15 rollingly engage a circular bearing groove 22 formed in the bottom surface of the upper

block 20 and another circular bearing groove 13 formed in the top surface of the lower block 11. The metallic rolling elements 15 may be balls or rollers, and the circular bearing grooves 13 and 22 have a cross section which suits the particular metallic elements employed in the thrust bearing. A bracket 26 has a flat top surface which engages the flat bottom surface of the lower block 11, and the lower end of the shaft 18 is secured in position in a central bore 26a of the bracket 26. A wheel shaft 26b extends across opposite side walls of the bracket 26, so as to rotatably carry a wheel 24 preferably made of a suitable non-metallic material, e.g., elastomeric or plastics material. To close the space between the upper block 20 and the lower block 11 for preventing foreign matter from entering therein, the top portion of the lower block 11 has a reduced diameter portion 12a and the upper block 20 has an annular fringe wall 23 depending from the bottom thereof so as to accommodate the reduced diameter portion 12a of the lower block 11, as shown in Figure 4.

It will be apparent to those skilled in the art that the furniture castor 40 of the aforesaid construction has all the features of the thrust bearing of the present invention including the low noise operation, the minimization of mechanical wear of the metallic rolling elements, and the ease of manufacture thereof.

WHAT WE CLAIM IS:—

1. A thrust bearing assembly comprising a pair of synthetic resin blocks, between which metallic rolling elements located by a synthetic resin retainer are rotatably disposed, the metallic rolling elements being balls or rollers, surfaces of the blocks which come in contact with the rolling elements having circular bearing grooves, so as to guide the rolling of the elements by receiving respective portions thereof, a shaft being rotatably disposed in and extending through centrally extending bores of the synthetic resin blocks and of the synthetic resin retainer, said bores being concentric with the circular bearing grooves of the blocks.

2. A thrust bearing assembly as claimed in claim 1, wherein said shaft has a top end thereof secured to a mounting plate, a relatively large diameter portion formed at the lower part thereof, and a disk-shaped portion formed at the lower end thereof so as to extend radially further than the outer periphery of said relatively large

diameter portion of the shaft; a cylindrical roller being rotatably fitted on the relatively large diameter portion of the shaft, the shaft extending through a central bore of said cylindrical roller, which is supported by said disk-shaped portion of the shaft; a lower one of said synthetic resin blocks being rotatably held above said relatively large diameter portion of the shaft on a relatively small diameter portion of the shaft; said retainer having uniformly spaced radial openings adapted to retain said rolling elements at uniform intervals in said bearing grooves.

3. A thrust bearing assembly as claimed in claim 2 wherein said lower block has an annular edge wall projecting upwardly from the periphery of the top surface thereof into a space between said lower block and said upper block, the upper one of the two blocks having an annular fringe wall depending from the lower end of the upper block so as to surround outside of the annular edge wall of the lower block.

4. A furniture castor which includes a thrust bearing assembly as claimed in claim 1, an upper one of said blocks having a threaded projection, the top end of the shaft having a disk-shaped expanded portion which rests on the top surface of the upper block, the threaded projection being threadedly engageable with a piece of furniture, the metallic rolling elements being located by radial openings of the retainer, a bracket having a top surface which engages a bottom surface of the lower block, the lower end of the shaft being secured in position in a central bore of the bracket, a wheel shaft extending across opposite side walls of the bracket, and rotatably carrying a wheel.

5. A furniture castor as claimed in claim 4, wherein a top portion of the lower block has a reduced diameter portion and the upper block has an annular fringe wall depending from the bottom thereof so as to accommodate the reduced diameter portion of the lower block.

6. A thrust bearing assembly substantially as herein described with reference to and as illustrated in Figures 1, 2 and 3 of the accompanying drawings.

7. A furniture castor substantially as herein described with reference to and as illustrated in Figures 4 and 5 of the accompanying drawings.

MARKS & CLERK,
Chartered Patent Agents,
Agents for the Applicants.

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block 20 and another circular bearing groove 13 formed in the top surface of the lower block 11. The metallic rolling elements 15 may be balls or rollers, and the circular bearing grooves 13 and 22 have a cross section which suits the particular metallic elements employed in the thrust bearing. A bracket 26 has a flat top surface which engages the flat bottom surface of the lower block 11, and the lower end of the shaft 18 is secured in position in a central bore 26a of the bracket 26. A wheel shaft 26b extends across opposite side walls of the bracket 26, so as to rotatably carry a wheel 24 preferably made of a suitable non-metallic material, e.g., elastomeric or plastics material. To close the space between the upper block 20 and the lower block 11 for preventing foreign matter from entering therein, the top portion of the lower block 11 has a reduced diameter portion 12a and the upper block 20 has an annular fringe wall 23 depending from the bottom thereof so as to accommodate the reduced diameter portion 12a of the lower block 11, as shown in Figure 4.

It will be apparent to those skilled in the art that the furniture castor 40 of the afore-said construction has all the features of the thrust bearing of the present invention including the low noise operation, the minimization of mechanical wear of the metallic rolling elements, and the ease of manufacture thereof.

35 WHAT WE CLAIM IS:—

1. A thrust bearing assembly comprising a pair of synthetic resin blocks, between which metallic rolling elements located by a synthetic resin retainer are rotatably disposed, the metallic rolling elements being balls or rollers, surfaces of the blocks which come in contact with the rolling elements having circular bearing grooves, so as to guide the rolling of the elements by receiving respective portions thereof, a shaft being rotatably disposed in and extending through centrally extending bores of the synthetic resin blocks and of the synthetic resin retainer, said bores being concentric with the circular bearing grooves of the blocks.

2. A thrust bearing assembly as claimed in claim 1, wherein said shaft has a top end thereof secured to a mounting plate, a relatively large diameter portion 55 formed at the lower part thereof, and a disk-shaped portion formed at the lower end thereof so as to extend radially further than the outer periphery of said relatively large

diameter portion of the shaft; a cylindrical roller being rotatably fitted on the relatively large diameter portion of the shaft, the shaft extending through a central bore of said cylindrical roller, which is supported by said disk-shaped portion of the shaft; a lower one of said synthetic resin blocks being rotatably held above said relatively large diameter portion of the shaft on a relatively small diameter portion of the shaft; said retainer having uniformly spaced radial openings adapted to retain said rolling elements at uniform intervals in said bearing grooves.

3. A thrust bearing assembly as claimed in claim 2 wherein said lower block has an annular edge wall projecting upwardly from the periphery of the top surface thereof into a space between said lower block and said upper block, the upper one of the two blocks having an annular fringe wall depending from the lower end of the upper block so as to surround outside of the annular edge wall of the lower block.

4. A furniture castor which includes a thrust bearing assembly as claimed in claim 1, an upper one of said blocks having a threaded projection, the top end of the shaft having a disk-shaped expanded portion which fits on the top surface of the upper block, the threaded projection being threadably engageable with a piece of furniture, the metallic rolling elements being located by radial openings of the retainer, a bracket having a top surface which engages a bottom surface of the lower block, the lower end of the shaft being secured in position in a central bore of the bracket, a wheel shaft extending across opposite side walls of the bracket, and rotatably carrying a wheel.

5. A furniture castor as claimed in claim 4, wherein a top portion of the lower block has a reduced diameter portion and the upper block has an annular fringe wall depending from the bottom thereof so as to accommodate the reduced diameter portion of the lower block.

6. A thrust bearing assembly substantially as herein described with reference to and as illustrated in Figures 1, 2 and 3 of the accompanying drawings.

7. A furniture castor substantially as herein described with reference to and as illustrated in Figures 4 and 5 of the accompanying drawings.

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